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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|---|---|---|---|
| 08/811,742 | 03/06/97 | ZHANG | H 0756-1641 |

| EXAMINER | |
|---|---|
| HAWRANEK,S | |
| ART UNIT | PAPER NUMBER |
| 2823 | |

DATE MAILED: 12/20/00

MMC2/1220

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

1- File Copy

| Office Action Summary | Application No. 08/811,742 | Applicant(s) Zhang et al. |
|---|---|---|
| | Examiner Scott J. Hawranek | Group Art Unit 2823 |

☒ Responsive to communication(s) filed on *Oct 4, 2000*.

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

**Disposition of Claims**

☒ Claim(s) *5, 12, 16, 19, and 26-75* is/are pending in the application.

Of the above, claim(s) *49-66* is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *5, 12, 16, 19, 26-48, and 67-75* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

**Application Papers**

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐approved ☐disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. § 119**

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

**Attachment(s)**

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

*--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---*

## DETAILED ACTION

### *Claim Objections*

1. Claims 67-75 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. These claims are interpreted as not further limiting because an additional range of more than 1 X $10^{15 \text{ or } 19}$ atoms/$cm^3$ is added to the original range, which is less than 1 X $10^{19}$ atoms/$cm^3$. Therefore, instead of limiting the range the proposed claims increase the range spectrum.

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5-8, 11-12, 16, 19, 27-48 and 67-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oka (JP '915) in combination with Liu et al. (US '826) and in combination with Kuznetsov (Inst. Phys. Conf.) and in combination with Kumomi.

Oka discloses a method of manufacturing a semiconductor device for the formation of an active matrix type electro-optical display having a driving circuit portion and display portion comprising the steps of forming an amorphous Si layer on a glass substrate by PECVD (pg. 6, translation), selectively forming a Ni layer (pg. 14, translation) of a thickness of 100-200

Angstroms, on a-Si layer in seed regions outside the regions slated to become TFT active regions, such that Ni does not diffuse into said active regions by abnormal diffusion, therefore the Ni is introduced into the seed regions by solid source diffusion. Thermally heating the Ni at 450 C° (pg. 6, translation) such that the Ni catalyst would diffusion through the semiconductor film forming crystal nuclei near the interface between the metal layer and the a-si layer. (pg. 7, translation) After diffusion of the catalyst through the semiconductor film the metal layer is removed to prevent abnormal diffusion (i.e. diffusion into the active layer of the TFT as defined pg. 7 of translation). Formation of semiconductor islands (fig. 2b) consisting of a first region and the formation of a semiconductor island consisting of a second region. Examiner previous official notice was not adequately contested, therefore, it is taken as admitted prior art that the formation of semiconductor islands is notoriously obvious in the art in order to provide device isolation.

Kuznetsov teaches that a metal catalyst induced crystallization occurs by lateral diffusion of the metal throughout the a-Si film. In addition, a concentration of $Ni^{+}$ ions to a maximum concentration of about $1.5X10^{20}$ $cm^{-3}$.(pg. 191-194) Thus, such a diffusion while not explicitly taught by Oka, is inherent in the process of Oka as a result the metal induced lateral crystallization. Then a-Si is thermally crystallized at 550 C°, where the grain nuclei ordinarily form in the seed regions and grain growth proceeds from said seed regions parallel to the substrate surface and TFT charge carrier flow (fig. 5-8). TFTs are subsequently formed in the crystal growth region. Oka does not explicitly anticipate leaving areas of the film amorphous.

However, Liu teaches forming regions of a-Si on Corning 7059 glass and some of the regions were not treated with Ni prior to a low temperature thermal treatment these regions remain amorphous. While a-Si regions which were treated with Ni are crystallized into polysilicon after said thermal treatment (Example 2). Liu teaches the selective crystallization of

certain regions is advantageous because it allows simultaneous formation of driver TFTs which require a low leakage current in the amorphous regions (col. 3, lines 10-17).

Therefore it would have been obvious to one of ordinary skill in the requisite art to leave a second region (disposing nickel in contact with a selected region of only the first region of the semiconductor film) of Oka amorphous by not providing a seed region. One of ordinary skill in the art at the time of the invention would have been motivated by Liu's teachings. That is in order to simultaneously obtain driver TFTs of high mobility in the polysilicon regions and pixel TFTs, which require a low leakage current in the amorphous regions. Therefore, Oka would have been motivated to incorporate these teachings of Liu for there disclosed intended purpose.

Kumomi teaches MILC or catalyst enhanced areas crystal growth takes place parallel to substrate (e.g. MILC). It is held, absent evidence to the contrary, that crystal growth of Oka would occur by this mechanism as it is a fundamental characteristic of the process. *See* In re Best, 195 USPQ 428 (CCPA 1977) and In re Fitzgerald, 205 USPQ 594 (CCPA 1980).

2. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oka (JP '915), in combination with Liu et al. (US '826) and in combination with Kuznetsov (Inst. Phys. Conf.) and in combination with Kumomi as applied to claims 5-8, 11-12, 16, 19, 27-48 above, and further in view of Yonehara (US '093) and/or Shibata (US '224 or JP '224).

Oka and Liu lack anticipation for irradiating the polysilicon after the thermal crystallization.

Yonehara and/or Shibata teach the irradiating the polysilicon after a thermal crystallization in order to improve the properties of the film, such as mobility. It would have been obvious to one of ordinary skill in the art to irradiate the polysilicon of Oka and Liu after the thermal crystallization in order to improve its mobility as taught by Yonehara and/or Shibata.

3. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oka (JP '915) in combination with Liu et al. (US '826) and in combination with Kuznetsov (Inst. Phys. Conf.) and in combination with Kumomi as applied to claims 5-8, 11-12, 16, 19, 27-48 above and further in view of Kuznetsov.

Kuznetsov teaches determining Ni concentration in metal induced crystallized silicon using SIMS (sec. 2)

Therefore, it would have been obvious to one of ordinary skill in the requisite art to test the metal induced crystallized silicon of Oka or catalyst containing material of Oka by SIMS to check for the presence of and to determine the distribution of deleterious metal impurities (Oka, pgs. 10-11 of translation ) as taught by Kuznetsov.

***Response to Arguments***

4. Applicant's arguments filed 10/4/00 have been fully considered but they are not persuasive.

Applicant asserts none of the references teach or suggest the features of independent claims 27, 29, 31, 36, 39, 42, 45, and 47 including disposing a metal containing material that is capable of promoting crystallization of a semiconductor film where the concentration of the metal is $\underline{1X10^{19}\ atoms/cm^3\ or\ lower}$. It is noted that the claim language reads on an interpretation of a Ni concentration of zero atoms/$cm^3$. As such clearly the rejections outlined above meet this limitation. In addition, Kuznetsov discloses a maximum Ni concentration of about $1X10^{20}$ atoms/$cm^3$. The concentration of Ni ions in the process taught by Oka is

substantially identically to applicants process. As such it is held absent evidence to the contrary that the Ni concentration would be $1X10^{19}$ atoms/$cm^3$ or lower.

***Conclusion***

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott J Hawranek whose telephone number is 703-305-0070. The examiner can normally be reached on Flex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 703-308-1948. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and N/A for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1778.

SJH
December 18, 2000

Charles Bowers
Supervisory Patent Examiner
Technology Center 2800